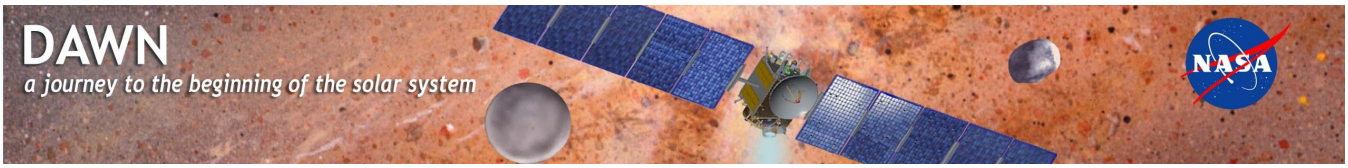


History and Discover of Asteroids

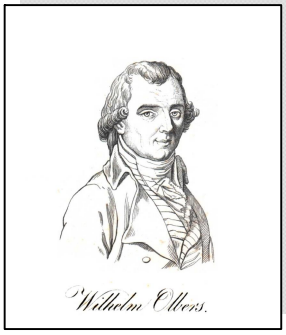
Astronomical Serendipity

FLASHBACK—EARLY ASTEROID DISCOVERIES

Since 1594, when **Johannes Kepler**[1] predicted that there should be a planet between Mars and Jupiter, astronomers had been searching for that "missing planet." When **Piazzi**[2] discovered **Ceres** in 1801, the scientific world thought that he had ended the search. Then Ceres disappeared from sight, only to be recovered[3] one year later. Astronomers breathed a sigh of relief and celebrated! The "missing planet" was back!

And Then There Were Two

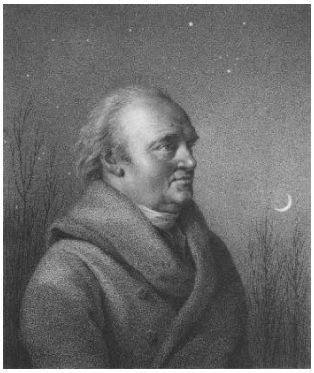
Wilhelm Olbers, an amateur German astronomer who was a doctor by profession, was again looking for Ceres about three months after it had been rediscovered. That was when he saw another moving object nearby! This "object", which was later named **Pallas,** caused quite a stir in the astronomical community. Only one planet had been expected in the space between Mars and Jupiter.



When **Gauss**[4] calculated this new object's orbit, he found that both Ceres and Pallas took 4.6 years to revolve around the sun. He also found that Pallas could be seen from the Earth for only a small portion of that time. It was incredible luck and timing or, maybe **astronomical serendipity** that Olbers was looking for Ceres during the short period of time that Pallas happened to be passing near Ceres. Otherwise, Pallas might not have been observed for many years.

Astronomers use mathematics to calculate periods of revolution.

In 1802, **William Herschel** tried to measure *the sizes* of both Ceres and Pallas. He did this by looking at each "planet" through a telescope while comparing it to a disk of a known size at a given distance. He was very surprised that these "planets" were so much smaller than the other known planets. Herschel was the first to call Ceres and Pallas **asteroids** because of their small but "starlike" appearance.

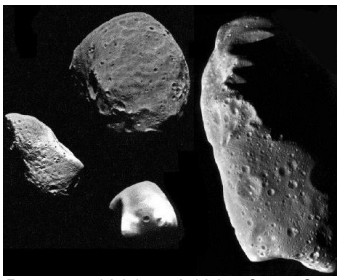

William Herschel
(1738-1822)

Scientific observations
- included measurements of size;
- led to new questions;
- new theories;
- new terminology; and
- new discoveries.

How Many More Fragments Are Out There?

As often happens, the results of this scientific discovery led to further questions. Could there be more than two asteroids? Where did these asteroids come from?

In 1804, Olbers formulated the first and oldest theory about the **origin of asteroids** in a letter to Herschel. He wrote, "Could it be that Ceres and Pallas are just a pair of fragments…of a once great planet which at one time occupied its proper place between Mars and Jupiter?" If this were the case, Olbers believed that many more asteroids would be discovered. Other astronomers thought that asteroids were pieces of a planet that never formed. They estimated that there were ten more asteroids.



Between 1801 and 1807, four of the largest or brightest asteroids had been discovered: Ceres, Pallas, Juno, and Vesta. Since then over 7,000 asteroids have been identified.

Olbers' belief that there were a great many asteroids to be discovered reactivated the **Celestial Police**[5]. They again made careful observations of promising regions of the sky at **Johann Schröter's** private observatory at Lilienthal. This was one of the largest observatories in the world at that time and was very close to Bremen where Olbers lived and worked. **Karl Harding** discovered a third asteroid, named **Juno**, on September 1, 1804. However, it was much smaller than either Ceres or Pallas.

Not only did Olbers predict there were many more asteroids, he proposed a theory about where these undiscovered asteroids could be found. Olbers thought that the asteroid fragments of an exploded planet were now in different orbits around the sun. Further, he believed these various orbits would intersect at a point 180 degrees away from the point of explosion. When he searched close to this point, he discovered **Vesta** on March 29, 1807. Olbers became the first person to find two asteroids.

So, by 1807, the two asteroids to be closely observed by the Dawn spacecraft had been discovered. As it turned out, the discovery of Vesta brought the first era of asteroid discovery to a close. Since the four largest and brightest asteroids had been found, then additional asteroid discoveries would depend on more advanced telescope technology.

In 1813, the French army burned the city of Lilienthal as they retreated from Russia. All of Schröter's books and observation records were destroyed and his observatory was looted. The Celestial Police disbanded and Olbers continued his lonely search of the heavens until 1816, when Schröter died. No more asteroids were found during the period between 1807 and 1845.

[1]see "Between Jupiter and Mars" vignette
[2]see "Dark and Starry Night" vignette
[3]see "Lost and Found" vignette
[4]see Lost and Found" vignette
[5]see "In Search of…" vignette

Additional Resources

http://www.bath-preservation-trust.org.uk/museums/herschel/
Informative Web site sponsored by The William Herschel Museum.

http://nssdc.gsfc.nasa.gov/planetary/planets/asteroidpage.html
NASA's "Asteroids and Comets" home page contains links to asteroid fact sheets, images, and information about NASA missions to the asteroid belt.

http://www.geocities.com/rasctb/asteroid.htm
History of asteroid discovery and formation theories.

Questions relating to Astronomical Serendipity

1. Herschel attempted to estimate the sizes of Ceres and Pallas. How did he do it? What did he determine?
2. Identify the astronomers involved in the first era of asteroid discovery. Where did they work and what contributions did they make?
3. What surprise did Wilhelm Obers find as he continued to observe Ceres after it had been re-discovered?
4. How did the period of revolution (time that it takes to orbit the sun) of Ceres and Pallas compare
5. Who first called Ceres and Pallas “asteroids”?
6. Who was the first astronomer to formulate a theory about how asteroids were formed? What was his theory?
7. How many asteroids were discovered during this first era of asteroid discoveries? What were these asteroids named?
8. What historical events took place as the first era of asteroid discoveries was ending?